

REMARKS

Applicant thanks the Examiner for the very thorough consideration given the present application. The Office Action of **January 19, 2001** has been received and its contents carefully noted. Filed concurrently herewith is a *Request for a Three (3) Month Extension of Time* which extends the shortened statutory period for response to **July 19, 2001**. Accordingly, Applicant submits that this response is timely filed.

Claims 1-8 were pending in the subject application prior to the aforementioned amendment. By this Amendment, claims 1, 2 and 8 have been amended and new claims 9 and 10 have been added to recite addition protection to which Applicant is entitled. Accordingly, claims 1-10 are now pending herein and are in condition for allowance at least for the reasons advanced hereinbelow.

The Office Action rejects claims 1, 3 and 5-8 under 35 U.S.C. §102(b) as anticipated by *Hsu et al.* (U.S. Patent No. 5,707,889). Applicant contends that the claimed invention (as amended) sets forth features which are patentably distinct over the *Hsu et al.* '889 patent at least for the following reasons. Reconsideration is earnestly solicited in view thereof.

The claimed invention is directed generally to a method of fabricating a semiconductor device with a large driving force. More particularly, the claimed invention in accordance with claim 1 is directed to a method of fabricating a semiconductor device comprises the steps of forming a silicon oxynitride film on a silicon substrate, performing a heat treatment while keeping a surface of the silicon oxynitride film in contact with a gas containing nitrogen to introduce at least nitrogen into the silicon oxynitride film, forming a semiconductor film containing an impurity of first conductivity type on the silicon oxynitride film, forming a gate electrode that composed of the semiconductor film by patterning the semiconductor film, and forming a

gate insulating film that composed of the silicon oxynitride film by patterning the silicon oxynitride film.

Accordingly, by introducing nitrogen into the silicon oxynitride film comprising a gate insulating film, the nitrogen concentration within the silicon oxynitride film is increased and a nitrogen concentration distribution having a steeply sloped configuration is obtained. Further, according to the uses of this silicon oxynitride film as a gate insulating film, the reduction in threshold voltage can be prevented and a transistor having a superior ON/OFF property and a high driving force is formed.

Note that “a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros. v. Union Oil Co. Of California*, 814 F.2d 628, 631, 2 USPQ2d 1051 (Fed. Cir. 1987). “The identical invention must be shown in as complete detail as is contained in the...claims.” *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913 (Fed. Cir. 1989).

Applicant respectfully contends that the *Hsu et al. '889* patent fails to expressly teach or inherently describe each and every element set forth in claimed invention necessary to support anticipation under §102. For instance, the *Hsu et al. '889* patent teaches a method of fabricating a semiconductor device wherein the formation of a field isolation region comprises the steps of forming on a silicon substrate 20, a pad layer 21 composed of a silicon oxynitride layer, applying N₂O onto the surface of the pad layer 21, forming an amorphous silicon layer 31 on the pad layer 21, forming a silicon layer 41 by annealing the amorphous silicon layer 31 in an inert gas, forming a silicon nitride layer 42 on silicon layer 41, patterning silicon layer 41 and silicon nitride layer 42, using silicon nitride layer 42 as a mask, and forming field isolation region 62 by thermal oxidation.

Moreover, the *Hsu et al. '889* patent discloses a method of forming a field isolation region by LOCOS oxidation, wherein the pad layer 21 composed of silicon

oxynitride layer and the silicon layer 41 are formed as a background film for the silicon nitride layer 42, which acts as an oxidation prevention mask during LOCOS oxidation. Accordingly, after forming the field isolation region 62, the pad layer 21 composed of the silicon oxynitride layer and the silicon layer 41 are removed and a new gate insulating film 82 and gate electrode 83 are formed. However, the pad layer 21 composed of the silicon oxynitride layer and the silicon layer 41 act neither as a gate insulating film nor a gate electrode respectively. Hence, the *Hsu et al.* '889 patent differs structurally from the claimed features of the present invention. In addition, the silicon layer 41 disclosed in the *Hsu et al.* '889 patent is only annealed in an inert gas, and does not include impurities of first conductivity type such as that which is set forth in the claimed invention. Hence, the silicon layer 41 disclosed in the *Hsu et al.* '889 patent differs functionally from that which is claimed in the present invention.

Accordingly, since the *Hsu et al.* '889 patent fails to expressly teach or inherently describe every claim limitation necessary to support anticipation under §102, it is respectfully requested that the rejection be reconsidered and withdrawn.

The Office Action rejects claim 2 under 35 U.S.C. §103(a) as unpatentable over *Hsu et al.* '889 in view of *Sung* (U.S. Patent No. 6,040,216), and claim 4 under 35 U.S.C. §103(a) as unpatentable over *Hsu et al.* '889. Applicant contends that the claimed invention (as amended) sets forth features which are patentably distinct over the proposed *Hsu et al.* '889 combination at least for the following reasons. Reconsideration is earnestly solicited in view thereof.

The claimed invention in accordance to claim 2 discloses a method of fabricating a semiconductor device wherein a silicon oxynitride film is formed by concurrently applying an N₂O gas and performing a heat treatment to the surface of the silicon substrate.

Note that three criteria must be met to establish a *prima facie* case of obviousness. *M.P.E.P.* §2143. First, there must be some suggestion or motivation, either in the

references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings to achieve the claimed invention. *Id.* Second, there must be a reasonable expectation of success. *In re Rhinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976). Third, the prior art must teach or suggest all the claim limitations. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).

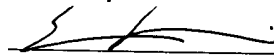
Applicant respectfully contends that the proposed *Hsu et al.* '889 combination fails to expressly teach or suggest all of the limitations set forth in claimed invention necessary to support a *prima facie* case of obviousness under §103. More particularly, it is contended that there is a lack of motivation in the prior art of record to either modify the *Hsu et al.* '889 patent or combine the respective teachings of the *Hsu et al.* '889 and *Sung* patents in order to achieve the claimed invention. For example, the *Sung* patent discloses a method of fabricating a semiconductor device wherein silicon oxynitride 117 is formed by annealing in oxygen after nitrogen is introduced to a surface of an active region 111 during an ion implantation step by using N₂O and the like (*See*, Fig. 3). Therefore, the method of forming the silicon oxynitride 117 by oxidizing the nitrogen introduced active region 111 disclosed in the *Sung* patent is completely different from what is claimed in claim 2 of the present invention, notably, a method of forming a silicon oxynitride film by concurrently applying an N₂O gas and performing a heat treatment.

Accordingly, since the proposed *Hsu et al.* '889 combination fails to expressly teach or suggest all of the limitations set forth in claimed invention necessary to support a *prima facie* case of obviousness under §103, it is respectfully requested that the rejection be reconsidered and withdrawn.

In view of the foregoing comments, Applicant respectfully contends that the claimed invention is patentably distinct over the prior art of record and that the pending claims are in proper condition for allowance. Reconsideration of these claims in view of

the above comments is respectively requested. If the Examiner believes further discussions with Applicants representative would be beneficial in this matter, he is invited to contact the undersigned.

Respectfully submitted,



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Marked up copy of amended claims.

1. (Amended) A method of fabricating a semiconductor device, the method comprising the steps of:

- (a) forming a silicon oxynitride film on a silicon substrate;
- (b) performing a heat treatment[,] while keeping a surface of the silicon oxynitride film in contact with a gas containing nitrogen[,] to introduce at least nitrogen into the silicon oxynitride film; [and]
- (c) after step (b), forming a semiconductor film containing an impurity of first conductivity type on the silicon oxynitride film;
- (d) after step (c), forming a gate electrode composed of the semiconductor film by patterning the semiconductor film;
- (e) after step (d), forming a gate insulating film composed of the silicon oxynitride film by patterning the silicon oxynitride film.

2. (Amended) The method of claim 1, wherein the silicon oxyitride film is formed by [using] concurrently applying an N₂O gas and performing a heat treatment to the surface of the silicon substrate in [the] step (a).

8. (Amended) The method of any one of claims 1 to 7, wherein the semiconductor device is a p-channel MIS transistor and a silicon film for a gate electrode containing boron is formed as the semiconductor film in [the] step (c).